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NOTES ON ORIENTAL *TAPHOZOUS* AND ALLIES

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Eight forms including 76 specimens represent the Taphozoine bats in the Archbold collections from the East Indies and Australia.

Originally all species were referred to *Taphozous* Geoffroy.[1] Subsequently *Saccolaimus* Temminck (= *Taphonycteris* Dobson) and *Liponycteris* Thomas were generically differentiated. For some time they have been treated as full genera, but because their affinities are so close, they ought probably to be considered subgenera of *Taphozous*. The taxonomic history of *Taphozous* follows.

Many years after Geoffroy's initial work, Temminck[2] reviewed the nine species known at his time. He employed (*loc. cit.*, p. 279) *Saccolaimus* (from the Kühl ms.) in the generic sense to indicate *T. saccolaimus*.

Dobson,[3] ignoring the generic use of *Saccolaimus* by Temminck (*loc. cit.*) and by Lesson (1842), separated the *saccolaimus* division under the name *Taphonycteris*, with *T. saccolaimus* type and additional species *affinis* and *peli*. But Miller[4] later showed that *Taphonycteris* Dobson was a synonym. Hollister[5] drew attention to the differentiation of the audital bullae in *Saccolaimus* and *Taphozous*, the latter having the bullae incomplete, or with internal fenestrae. Thomas[6] emphasized the distinctness and proposed several new races of *Taphozous*. Seven years later he[7] confirmed his 1915 classification of *Taphozous* and *Saccolaimus* but separated the *nudiventris* group from *Taphozous* under the name *Liponycteris*. Finally Troughton[8] revised the Australian members of the two subgenera *Saccolaimus* and *Taphozous*. He traced the usage of *Saccolaimus* in the generic sense as from Temminck. Formerly it had been attributed to Lesson, 1842.

In 1937 I had the opportunity to examine a number of the types in Europe and to photograph their skulls. In the case of *Saccolaimus saccolaimus* the co-typical series at Leyden contains two species: true *S. saccolaimus* and *longimanus*, subspecies *kampenii*, a *Taphozous*, which Jentink[9] had regarded as young specimens of *saccolaimus*. Of his series of mounted specimens "a–f" I saw "a–e." Specimens "a," "b" and "c" were true *saccolaimus*. Dr. Junge had the skull of specimen "a" extracted and cleaned for me. Observations and measurements were made upon it. Specimens "e" and "f" were not *saccolaimus* but, as already stated, *longimanus*. Specimen "a," skin and skull may be regarded as the "lectotype" (a single specimen chosen from the type series) of *Taphozous saccolaimus* Temminck.

Saccolaimus and *Taphozous* (excluding *Liponycteris*, chiefly of the arid tropics—Abyssinia and Eritrea to northwest India) have become specialized in divergent ways: In its skull characters *Saccolaimus*

[1] Geoffroy, 1813, Descr. de l'Egypte, II, p. 113.
[2] Temminck, 1841, Monographies des Mammifères, II, pp. 273–291.
[3] Dobson, 1875, Proc. Zool. Soc., London, p. 548; 1878, Cat. Chiropt. Brit. Mus., p. 388.
[4] Miller, 1907, "Families and genera of bats," pp. 93–94.
[5] Hollister, 1913, Proc. U. S. Nat. Mus., XLVI, pp. 307–308.
[6] Thomas, 1915, Jour. Bombay N. H. Soc., XXIV, pp. 57–63.
[7] Thomas, 1922, Ann. Mag. Nat. Hist., (9) IX, pp. 266–267.
[8] Troughton, 1925, Records Australian Mus., XIV, No. 4, pp. 314–341.
[9] Jentink, 1888, Mus. d'Hist. Nat. des Pays-Bas, XII, p. 198.

saccolaimus is more conservative than *Taphozous perforatus* (genotype of *Taphozous*); its audital bullae are entire, the *basis cranii* is but little fenestrated; the paroccipital processes are shorter; p^2 is relatively large and laterally uncompressed, the lower incisors and p_{2-4} are relatively heavy teeth. In *perforatus* the reverse is the case, p^2, the lower incisors and lower premolars are compressed, and in addition the pterygoid hamuli are very long and delicate. Structures in which *saccolaimus* may be regarded as the more specialized of the two are the helmet-shaped posterior sagittal crest and the greatly enlarged sphenoidal pits[1] which in this species become recessed over the eustachian region.

In the skins, the throat pouch developed by *Saccolaimus* is a specialization, but, as it is connected with sex, appears to be somewhat variable in taxonomic usefulness. The accentuation of the bare areas on the legs and thighs is another mark of specialization. *Saccolaimus* is restricted to the Orient and Australia; *Taphozous* is present almost throughout the Old World tropics.

The oriental species referable to the subgeneric divisions may be listed as follows:

Saccolaimus	
saccolaimus Temminck	Java
affinis Dobson	Labuan
flavimaculatus Sody	E. Borneo
flaviventris Peters	Australia
= *hargravei* Ramsay	E. coast N. S. Wales
= *insignis* Leche	S. Australia
mixtus Troughton	Port Moresby, Papua
nudicluniatus de Vis	Cardwell, Queensland
= *granti* Thomas	Mimika R., Dutch New Guinea
pluto Miller	Mindanao, Philippine
= *capito* (Hollister)	Catanduanes Is., Philippine
crassus Blyth	
pulcher Dobson	
Taphozous	
T. longimanus Hardwicke	Calcutta
T. l. bicolor Temminck	Calcutta?
T. l. fulvidus Blyth	
T. l. brevicaudatus Blyth	
= *cantori* Blyth	
T. l. kampenii Jentink	Java
T. l. leucopleurus Dobson	Flores
T. l. albipinnis Thomas	Labuan, Borneo
T. melanopogon Temminck	Java
T. m. fretensis Thomas	Terutau Is., Straits of Malacca
T. m. cavaticus Hollister	Pedang, W. Sumatra
T. m. philippinensis Waterhouse	Philippines
T. m. solifer Hollister	Peking, China
T. m. achates Thomas	Savu Is., West of Timor
T. theobaldi Dobson	Tenasserim
T. t. secatus Thomas	Central Prov. India
T. australis Gould	Australia
= *fumosus* de Vis	
T. georgianus Thomas	King George Sound
Liponycteris (we merely list the Oriental members of this group of species)	
nudiventris Cretzschmar (genotype)	N. Africa
kachhensis Dobson	Kachh, N. W. India
k. magnus Wettstein	Basra
= *babylonicus* Thomas	Euphrates R.
k. nudaster Thomas	Mt. Popa, Burma

[1] Sphenoidal pits are nevertheless characteristic of the family Emballonuridae.

Subgenus Saccolaimus Temminck

Of the named forms listed we have photographs of the type of all the following: *saccolaimus, affinis, flavimaculatus, granti.*

With *Saccolaimus* (with entire bullae, uncompressed p^2, as defined by Troughton) the following distinct cranial types can be observed:

1.—Sagittal crest high, and projecting helmet-like, backwards over supraoccipital; anterior half of zygoma relatively deep (1.5 mm. or more); basisphenoid pits recessed above their anterior margins. Pits large, their posterior margins only 2 mm. from median part of notch of foramen magnum in basioccipital. To this group are referable *saccolaimus flavimaculatus, affinis, pluto* (= *capito*), and the Australian *nudicluniatus* (= *granti* ?).

2.—Sagittal crest low, scarcely projecting behind supraoccipital; anterior half of zygoma little deepened (less than 1.5 mm. except right at maxillary root); basisphenoid pits often recesses posteriorly—above the basioccipital. Pits smaller; 3 mm. from foramen magnum.

Only Australian-New Guinean bats are referable: *flaviventris*, and *mixtus*.

Saccolaimus saccolaimus (Temminck)

Taphozous saccolaimus Temminck, 1841, Monogr. Mamm., II, pp. 285–286.

Type Region.—Java.

Material Examined.—The series of co-

typical specimens, Leyden, "a–c"[1] with photograph of skull "h,"[2] the last stated by Jentink to be that figured by Temminck. A series of 8 skins and skulls from Cheribon, N. coast of Java.

Saccolaimus affinis (Dobson)

Taphozous affinis DOBSON, 1875, Ann. Mag. Nat. Hist., (4) XVI, p. 232.

TYPE LOCALITY.—Labuan, Borneo.

MATERIAL EXAMINED.—Type of *affinis*, ♂, B.M. 74.10.26.2, skull photographed; a series of 6 from Sampit-Perit (Tjempaga), S. Borneo, collected by J. J. Menden.

At first sight the creamy white underparts and wing membranes of these bats set them off very sharply from the previous species. But actually it is not possible to show the smallest structural difference between this material from S. Borneo and *saccolaimus* from Cheribon, Sumatra. Even the scattering of small white spots in the dorsal pelage, perhaps resulting from attacks by parasites, is present. The gular sac in females appears to me exactly like that in *saccolaimus*.

Flavimaculatus Sody, whose type was studied in 1937, is very like true *saccolaimus* both in appearance and measurement. Its peculiarities of color, pointed out by the describer,[3] form part of the problem of whitening of the underfur and wing membranes in the taphozoine bats. White-winged forms turn up in relatively unrelated species, e.g., *affinis* in *saccolaimus*, *leucopleurus* in *longimanus*, and *leucopterus* among the South African representatives of the genus. *Pluto*, with synonym *capito*,[4] from its published measurements, though rather smaller, must be very near *saccolaimus*.

The last of the "helmeted" forms is the Australian *nudicluniatus* de Vis, of which Troughton (*loc. cit.*) has published good photographs and of which we have one specimen. Our photograph of the type skull of *granti* (a female), synonymized by Troughton with *nudicluniatus*, shows no "helmet." So perhaps the helmeted condition is more developed in males.

Saccolaimus, near mixtus Troughton

Saccolaimus mixtus TROUGHTON, 1925, Records Australian Mus., XIV, 4, pp. 322–325.

MATERIAL.—Adult male, Dogwa, Oriomo R., western division, Papua. From limestone cave.

This unique specimen agrees closely in its structure and measurements with *mixtus*, only differing in the color of the underparts. Our specimen has the underparts, but not the wings, a very pale grayish white, while the underparts of Troughton's species were "of a peculiar light shade of grayish buff-brown." Is it possible that the type of *mixtus*, which had been in alcohol since at least 1878, may be discolored? Our specimen is so light beneath as to be considered white-bellied like *affinis* and *flaviventris*.

Some measurements: forearm, 61 mm.; condylo-canine length, 61.5; zygomatic width, 14.1; interorbital width, 7.6; intertemporal width, 5.7; width braincase, 10.2; mastoid width, 12.3; length of basisphenoid pits, 3.3; c–m^3, 9.7.

Saccolaimus flaviventris (Peters)

Taphozous flaviventris PETERS, 1867, Proc. Zool. Soc., London, p. 430.

MATERIAL.—A series of 6 females with skulls from Pentland, North Queensland.

All specimens are very dark fuscous brown, except one female in which there is an admitxure of light brown. Underparts of all yellowish white to roots of hairs.

No throat pouch but the hairs there are very short. Forearms, 74–78 mm. Toothrows, c–m^3, ±11 mm.

These specimens appear to be wholly typical of the species described by Peters.

A single male skin, without skull, from Malbon near Pentland is referred here. The dorsal color is as dark as the series above, but the ventral pelage is colored light mouse-gray. Forearm, 74 mm.

Saccolaimus nudicluniatus de Vis

Saccolaimus nudicluniatus DE VIS, 1905, Ann. Queensland Mus., No. 6, pp. 39–40.

[1] Jentink, 1887, Mus. d'Hist. Nat. des Pays-Bas, IX, p. 287.
[2] Jentink, 1888, Mus. d'Hist. Nat. des Pays-Bas, XII, p. 197.
[3] 1931, Natuurk, Tijdschr. Ned. Indie, III, pp. 355–360.
[4] See Lawrence, 1939, Bull. Mus. Comp. Zoöl., LXXXVI, p. 42.

Taphozous granti THOMAS, 1911, Ann. Mag. Nat. Hist., (8) VIII, pp. 378–379.

Saccolaimus nudicluniatus TROUGHTON, 1925, Records Australian Mus., pp. 325–328.

MATERIAL.—One specimen in alcohol, A.M.N.H. 66144, Babinda Creek, N. Queensland.

SUBGENUS **TAPHOZOUS** GEOFFROY

Of this group of taphozoine bats (with incomplete bullae) our collections include three forms from the Sunda region, whose skins are readily separable from all others while their skulls can be distinguished only with difficulty. They are a small white-winged form from S. Borneo, forearm, 54 mm., *albipinnis;* a small brown form, *kampenii*, with the nape straw-colored, forearm, 56 mm., from Bali; and true *melanopogon*, males with ample "black beard," forearm, 61 mm., from Bali. The first two, represented also by males, have well-developed throat pouches, *melanopogon*, of course, none.

Skull characters separating the three are extremely slight; the inferior margins of the orbits of the first two equal arcs of circles; that in *melanopogon* is flatter. The inferior anteorbital process of *melanopogon* projects strongly in front of the orbit, and its infraorbital foramen is much smaller than in the others (diameter, 0.6 mm.: 0.8–0.9 mm.). Its molars are very slightly heavier. The width of basioccipital, between cochleae is a little greater (2.1 mm.: 1.7–1.8).

It is almost impossible to separate the first two by means of skull characters alone. Possibly the well-developed post-orbital process on the zygoma in *kampenii* will suffice, but it is by no means obsolete in the white-winged form.

Taphozous longimanus kampenii Jentink

Taphozous kampenii JENTINK, 1907, Notes Leyden Mus., XXIX, pp. 65–67.

MATERIAL.—Photograph of the type, Leyden, No. 1563, specimen "a"; and a series of seven specimens from Oboed, Bali; one adult male (the only specimen to exhibit the straw-colored nape), 4 adult females (2 lack skulls); 1 young male, 1 young female.

The females lack the pouch, although its position in adults is marked by a bare area outlined by a U-shaped fringe of body-hairs. The young animals of both sexes are much darker—almost fuscous.

Skins "d" and "e" of the co-typical series of *S. saccolaimus* are referable here. The skull of "d" was cleaned for me in Leyden (its c–m^3, only 8.4 mm.). Jentink[1] wrote of "individus, adultes et jeunes," but while the adults were true *saccolaimus*, the young were *kampenii*.

Jentink writes that the forearm of his male specimen from Batavia measures 57 mm. Our old male measures 57 mm., the females 55–57. The virtual impossibility of distinguishing between the skulls of these bats and those of *albipinnis*, and their decided similarity to the skulls of *melanopogon* have been mentioned.

Taphozous longimanus albipinnis Thomas

Taphozous longimanus albipinnis THOMAS, 1898, Ann. Mag. Nat. Hist., (7) II, p. 246.

MATERIAL.—Photograph of skull of type (collected by Everett in Labuan), B.M. 93.4.1.29, ♀, and two male specimens obtained by von Plessen in swamp forest at Sampit-Perit (Tjempaga), S. Borneo.

These individuals (forearms, 52, 54 mm.; Thomas gave 56 for the female type), though a shade smaller, agree closely with the original description as regards color, etc. Toothrows, c–m^3, 8.1, 8.2; in type, 8.5; in *leucopleurus* Dobson from Flores, 8.8.

Taphozous melanopogon Temminck

Taphozous melanopogon TEMMINCK, 1841 Monogr. Mamm., II, pp. 287–288.

MATERIAL.—Photograph of Leyden co-type skull "a," a series of 16 specimens from Noesa Penida, Tjimingan, Bali.

The series appears to be typical. The likeness of skulls of *melanopogon* to those of *longimanus* has been mentioned. Four of our specimens have the strongly developed black beard for which the species was named.

T. melanopogon is apparently very wide-

[1] Jentink, 1888, Mus. d'Hist. Nat. des Pays-Bas, XII, p. 198.

ranging. Phillips[1] records it in Ceylon and G. M. Allen[2] reports four from Yunnan. Allen (*loc. cit.*) regards *solifer* Hollister as a stray *philippinensis*, carried adventitiously to Peking.

Taphozous georgianus Thomas

Taphozous australis georgianus THOMAS, 1915, J. Bombay N. H. Soc., XXIV, p. 62.

Taphozous georgianus TROUGHTON, 1925, Records Australian Mus., pp. 336–339.

MATERIAL.—Photograph of the type B.M. 44.2.27.59; large series of 23 from Quamby of which 9 are males; 3 males, 1 female from Pentland, and three females from Albany Island, type locality of *australis*.

These specimens agree in all of the characters given by Troughton in his key, with *georgianus*. But the evident wide distribution of *georgianus* in Queensland seems to dispose of Troughton's idea (*loc. cit.*, p. 339) that *australis* and *georgianus* are geographically segregated. Incidentally, this supports his contention that the two are good species.

T. georgianus, lacking as it does all trace of gular pouch, may possibly be the representative in Australia of the *melanopogon* group of bats.

[1] Phillips, 1935, Manual of the Ceylon, p. 143.
[2] Allen, 1938, Mammals of China and Mongolia, I, pp. 159–161.